PJLink Specifications

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1. Overview

As the demand for projectors/displays increases with the popularization of personal computers, many manufacturers have branched out into projector/display markets.
With the recent diversification of digital media and growth of IP networks, projectors/displays with a higher utility value, namely support for networks, become popular in the market.
Network-ready projectors/displays provide significant convenience for users: the constraints of placement location and distance are relaxed and it is possible to control and monitor more than one projector/display at once.
However, the convenience can be impaired by differences among manufacturers in control system configuration and command type. Projector/Display control software provided by a specific manufacturer can be used only for projectors/displays manufactured by the same manufacturer and would be useless in a large-scale system where multiple projectors/displays with different control systems and command types are to be controlled/monitored simultaneously. Some users have independently developed very complicated control software.

In order to eliminate such inconvenience and to promote network-ready projectors/displays, JBMIA has been working on the standardization of protocol used for controlling projectors/displays. Thus, a standard protocol for projectors/displays, “PJLink”, was designed.

It will be possible to control/monitor projectors/displays of different manufacturers or models with single-application software if the projectors/displays support “PJLink” a standard protocol for controlling projectors/displays. As a result, user convenience will be greatly improved. Especially, the time and cost for introducing projectors/displays as part of a system would be reduced, encouraging large-scale introduction of projectors/displays into firms and organizations.

This specification document defines Class 2 specifications which add and review the control command and also add the device search function and the spontaneous state notification function to Class 1, which performs the basic control of the projector/display.
In JBMIA, we plan to define other PJLink Classes tailored to the functions and purposes sequentially.

In "PJLink Class 2,” the followings are defined:

- Device search
- Procedure of connecting with a projector/display via network
- Security
- Control command form
- Spontaneous status notification

This document was prepared to complement Japanese document and the Japanese document have a priority to any contents of this document.

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2. Command Format

2.1. Command line

The structure of a PJLINK command line is as follows:

Header + Class	Command body	Separator (Space)	Transmission parameter	Terminator (CR)
2 bytes	4 bytes	1 byte	128 bytes or less	1 byte

The character strings that make up the PJLink command are all ASCII codes unless otherwise noted.

All PJLINK command lines, without exception, start with '%'.

Added to the PJLINK header '%' is a 1-byte ASCII numeric character that shows the PJLINK class.

In the command prescribed from Class 1, 1 is added, and in the command added from Class 2, 2 is added.

The command body is a 4-byte fixed-length string predetermined for each command.

The separator separates the command body from the transmission parameter. In command lines, a blank character (space: 0x20) is always used as the separator.

The transmission parameter is a variable-length string that can contain up to 128 bytes.

All command lines end with a terminator (carriage return code (CR): 0x0d).

The command body is case-insensitive. The transmission parameter may be case-sensitive when treated as an arbitrary string in accordance with the specifications of each command.

2.2. Response line

The structure of a response to a PJLINK command (hereinafter, simply "response") is as follows:

Header + Class	Command body	Separator (=)	Response parameter	Terminator (CR)
2 bytes	4 bytes	1 byte	128 bytes or less	1 byte

The header and class of a response are the same as those of a command.

The command body contains the entire command line received by the projector/display.

The separator separates the command body from the response parameter. Unlike in the case of a command, '=' (equal: 0x3d) is always used for the separator of a response.

The response parameter contains the description of the response to the command. The parameter is a variable-length string that can contain up to 128 bytes.

All responses end with a terminator (carriage return code (CR): 0x0d).

The command body is case-insensitive. The response parameter may be case-sensitive when treated as an arbitrary string in accordance with the specifications of each command.

2.3. Set commands

Commands fall into two broad categories: set command and get command.

Set commands are for operating the projector/display and changing the settings of the projector/display.

The parameter of a set command contains setting descriptions defined by the command.

The response parameter of a response to a set command generally contains any of the following response codes. Detailed specifications of each command are given in Chapter 4.

The undefined command (ERR1) will be returned when received the unsupported commands by projectors/displays.

Definitions	Response codes
Successful execution	OK
Undefined command	ERR1
Out of parameter	ERR2
Unavailable time	ERR3
Projector/Display failure*	ERR4

* This is defined as a state in which the projector/display cannot continue to operate properly.

2.4. Get commands

The get command is used to obtain the current setting information of and data saved in the projector/display.

The parameter part of a get command contains the '?' character, which identifies itself as a get command.

If the obtainment of info/data by the get command is successfully completed, the corresponding values are saved into the parameter part of the response based on the specifications of each command.

If the get command fails, generally any of the response codes listed below will be saved into the parameter part of the response. Detailed specifications of each command are given in Chapter 4.

If the command cannot be received when stand-by, the same error response as Unavailable Time will be returned. Detail information can be obtained from specifications of each projector/display.

The undefined command (ERR1) will be returned when received the unsupported commands by projectors/displays.

Definitions	Response codes
Undefined command	ERR1
Out of parameter	ERR2
Unavailable time	ERR3
Projector/Display failure*	ERR4

* This is defined as a state in which the projector/display cannot continue to operate properly.

2.5. Format

Set command

1 byte	1 byte	4 bytes	1 byte	Variable length	1 byte
%	Class	Command	Space	Transmission parameter	Carriage return code (CR)

[Successful execution] response

1 byte	1 byte	4 bytes	1 byte	2 bytes	1 byte
%	Class	Command	=	OK	Carriage return code (CR)

[Undefined command] response

1 byte	1 byte	4 bytes	1 byte	4 bytes	1 byte
%	Class	Command	=	ERR1	Carriage return code (CR)

[Out of parameter] response

1 byte	1 byte	4 bytes	1 byte	4 bytes	1 byte
%	Class	Command	=	ERR2	Carriage return code (CR)

[Unavailable time] response

1 byte	1 byte	4 bytes	1 byte	4 bytes	1 byte
%	Class	Command	=	ERR3	Carriage return code (CR)

[Projector/Display failure] response

1 byte	1 byte	4 bytes	1 byte	4 bytes	1 byte
%	Class	Command	=	ERR4	Carriage return code (CR)

Get command

1 byte	1 byte	4 bytes	1 byte	1 byte	1 byte
%	Class	Command	Space	?	Carriage return code (CR)

[Successful execution] response

1 byte	1 byte	4 bytes	1 byte	Variable length	1 byte
%	Class	Command	=	Response parameter	Carriage return code (CR)

[Undefined command] response

1 byte	1 byte	4 bytes	1 byte	4 bytes	1 byte
%	Class	Command	=	ERR1	Carriage return code (CR)

[Unavailable time] response

1 byte	1 byte	4 bytes	1 byte	4 bytes	1 byte
%	Class	Command	=	ERR3	Carriage return code (CR)

[Projector/Display failure] response

1 byte	1 byte	4 bytes	1 byte	4 bytes	1 byte
%	Class	Command	=	ERR4	Carriage return code (CR)

3. Protocol

3.1. Control protocol

The TCP/IP protocol is used for communication between the adaptable projector/display and the controlling PC.

The projector/display is set as the server and the CONTROLLER as the client. In other words, establishment and termination of communication are determined by the client CONTROLLER (hereinafter, “CONTROLLER”).

Port name　pjlink	TCP　4352 port

To operate multiple projectors/displays, the CONTROLLER creates a TCP/IP session per projector/display. The CONTROLLER identifies each projector/display by its IP address.

The CONTROLLER controls the projector/display by sending PJLINK commands. Upon receiving a command, the projector/display returns a predetermined PJLINK response. Such sending and response attains the smallest unit of controlling communication. Details of PJLINK commands and the responses to them are given in Chapter 4.

3.2. Search protocol

The UDP protocol is used for searching a projector/display.
A search start command is sent from the controller side, and the projector/display side transmits a search response after receiving the search start command.

Port name　pjlink	UDP　4352 port

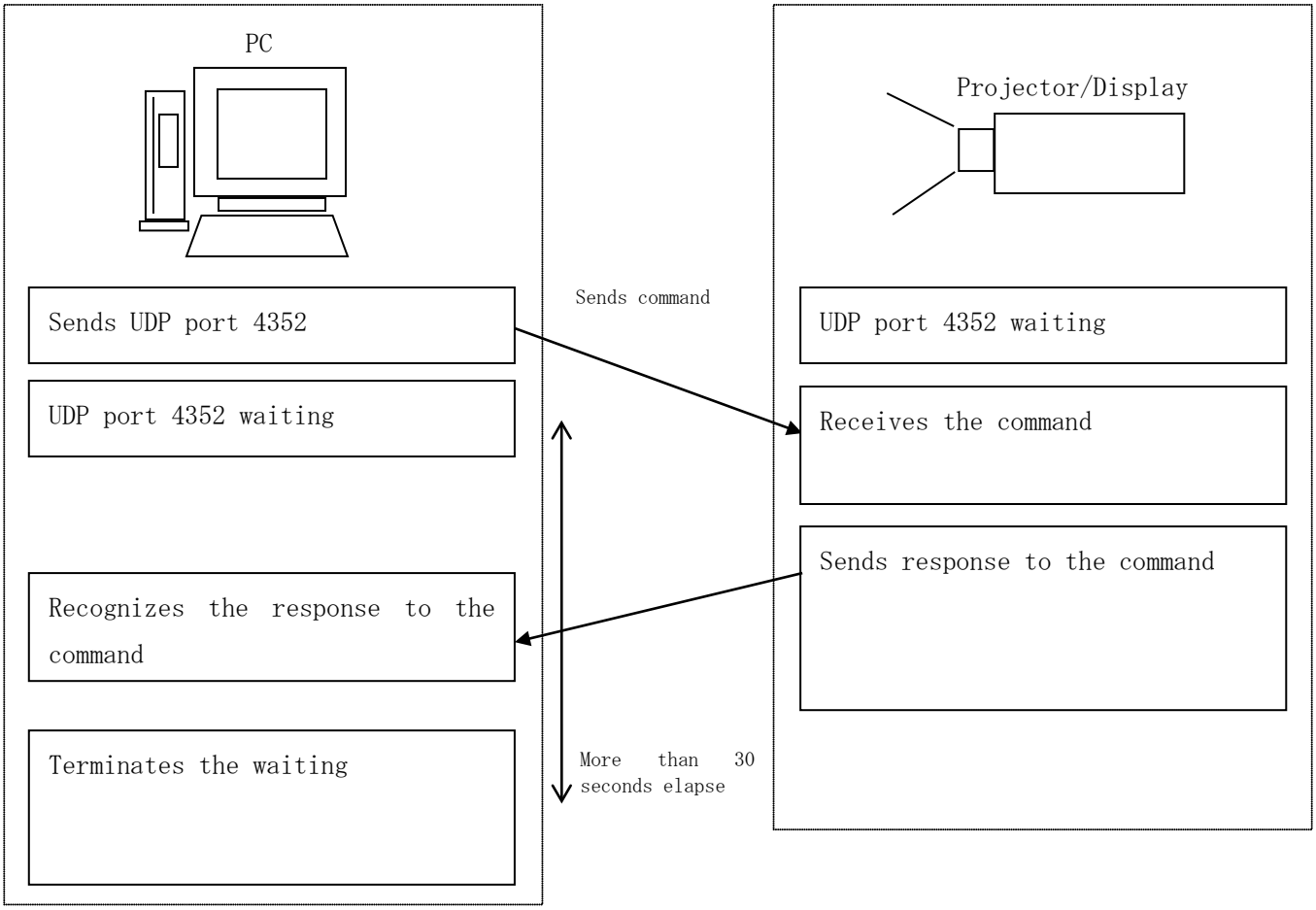
The controller can search the projectors in the network by sending a search start command to the broadcast address (e.g., 192.168.0.255 when the subnet address is 255.255.255.0, or ff02::1 for IPv6).
In the search response of the projector, the MAC address of the projector is prescribed, and access to the projector can be made based on this information.

3.2.1. Search protocol procedure

The search procedure is as follows.

1. A search start command is transmitted to the broadcast address from the controller.
2. The controller receives all of the responses from the projectors/displays for 30 seconds.
3. After receiving the search start command from the controller, the projector/display transmits a search response in random time (0 to 10 seconds).
4. Upon receiving the response, the controller accesses the projector, based on the MAC address in the search response or the information on the IP address for the communication packet.

Fig. 1 Procedure of search protocol



3.2.2. Command descriptions

Search start instruction

Character code in hexadecimal	25	32	53	52	43	48	0d
Character	%	2	S	R	C	H	(CR)

Search response

Character code in hexadecimal	25	32	41	43	4B	4E	3D		…		0d
Character	%	2	A	C	K	N	=		*1		(CR)

*1 MAC address of projector/display
The form of MAC address will be xx:xx:xx:xx:xx:xx.

3.3. Status Notification Protocol

The UDP protocol is used for noticing the state of the projector/display.

Port name　pjlink	UDP　4352 port

As for the IP address registered in advance, the projector/display spontaneously transmits a command to the controller when the state changes.
The state change refers to the following cases.

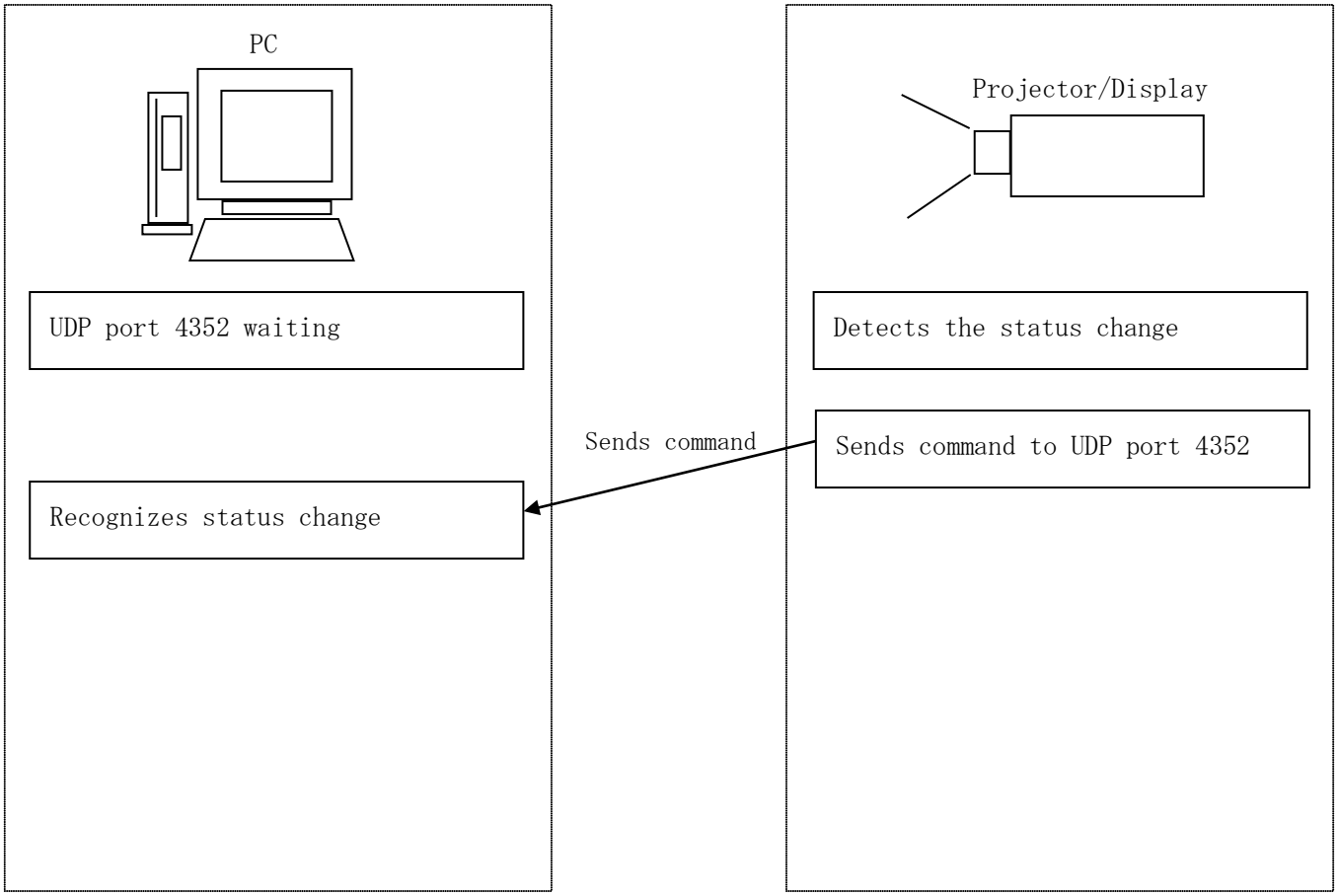
- At the time of transition to the warm-up state (or at the time of transition to the power on (lamp on) state when there is no warm-up)
- At the time of transition to the cooling state (or at the time of transition to the power off (standby) state when there is no cooling)
- At the time of change to Error condition
- When PJLink communication is ready (when the power cable for the projector/display is connected)
- When input switching is completed

3.3.1. Procedure of status notification protocol

The status notification procedure is as follows.

1. The projector/display detects a state change.
2. The projector/display sends a status notification command to the controller.

Fig. 2 Procedure of status notify protocol



3.3.2. Command descriptions

Status notify command (Linkup status)

Character code in hexadecimal	25	32	4C	4B	55	50	3D		…		0d
Character	%	2	L	K	U	P	=		*1		(CR)

*1 MAC address of projector/display
The form of MAC address will be xx:xx:xx:xx:xx:xx.

Status notify command(Error status)

Character code in hexadecimal	25	32	45	52	53	54	3D							0d
Character	%	2	E	R	S	T	=	*1	*2	*3	*4	*5	*6	(CR)

*1 Fan error; any of 0–2
*2 Lamp error; any of 0–2
*3 Temperature error; any of 0–2
*4 Cover open error; any of 0–2
*5 Filter error; any of 0–2
*6 Other errors; any of 0–2

0: No error detected or no error detecting function
1: Warning
2: Error

Status notify command(Power status)

Character code in hexadecimal	25	32	50	4F	57	52	3D		0d
Character	%	2	P	O	W	R	=	*1	(CR)

*1 Power status
0 : Power-off(standby) status or cooling-down status
1 : Power-on(lamp-on) status or warm-up status

Status notify command(Input status)

Character code in hexadecimal	25	32	49	4E	50	54	3D			0d
Character	%	2	I	N	P	T	=	*1		(CR)

*1 Input terminal after the change
11～6Z detail in [4.4 INPT]

4. Command Descriptions

4.1. Power control instruction POWR

Power-on (lamp-on) instruction

Character code in hexadecimal	25	31	50	4f	57	52	20	31	0d
Character	%	1	P	O	W	R	(SP)	1	(CR)

Power-off (standby) instruction

Character code in hexadecimal	25	31	50	4f	57	52	20	30	0d
Character	%	1	P	O	W	R	(SP)	0	(CR)

Response

Successful execution (including power-on instruction under power-on status and power-off instruction under power-off status)

Character code in hexadecimal	25	31	50	4f	57	52	3d	4f	4b	0d
Character	%	1	P	O	W	R	=	O	K	(CR)

Out-of-parameter

Character code in hexadecimal	25	31	50	4f	57	52	3d	45	52	52	32	0d
Character	%	1	P	O	W	R	=	E	R	R	2	(CR)

Unavailable time

Character code in hexadecimal	25	31	50	4f	57	52	3d	45	52	52	33	0d
Character	%	1	P	O	W	R	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	31	50	4f	57	52	3d	45	52	52	34	0d
Character	%	1	P	O	W	R	=	E	R	R	4	(CR)

*Commands are case-insensitive.

4.2. Power status query POWR ?

Power status query

Character code in hexadecimal	25	31	50	4f	57	52	20	3f	0d
Character	%	1	P	O	W	R	(SP)	?	(CR)

Response

Power-off (standby) status

Character code in hexadecimal	25	31	50	4f	57	52	3d	30	0d
Character	%	1	P	O	W	R	=	0	(CR)

Power-on (lamp-on) status

Character code in hexadecimal	25	31	50	4f	57	52	3d	31	0d
Character	%	1	P	O	W	R	=	1	(CR)

Cooling status

Character code in hexadecimal	25	31	50	4f	57	52	3d	32	0d
Character	%	1	P	O	W	R	=	2	(CR)

Warm-up status

Character code in hexadecimal	25	31	50	4f	57	52	3d	33	0d
Character	%	1	P	O	W	R	=	3	(CR)

Unavailable time

Character code in hexadecimal	25	31	50	4f	57	52	3d	45	52	52	33	0d
Character	%	1	P	O	W	R	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	31	50	4f	57	52	3d	45	52	52	34	0d
Character	%	1	P	O	W	R	=	E	R	R	4	(CR)

*Commands are case-insensitive.

4.3. Input switch instruction INPT

Instruction to switch input to RGB (Class1)

Character code in hexadecimal	25	31	49	4e	50	54	20	31		0d
Character	%	1	I	N	P	T	(SP)	1	*1	(CR)
*1: values 1–9										

Instruction to switch input to RGB (Class2)

Character code in hexadecimal	25	32	49	4e	50	54	20	31		0d
Character	%	2	I	N	P	T	(SP)	1	*1	(CR)
*1: values 1–9 and A~Z										

Instruction to switch input to VIDEO (Class1)

Character code in hexadecimal	25	31	49	4e	50	54	20	32		0d
Character	%	1	I	N	P	T	(SP)	2	*1	(CR)
*1: values 1–9										

Instruction to switch input to VIDEO (Class2)

Character code in hexadecimal	25	32	49	4e	50	54	20	32		0d
Character	%	2	I	N	P	T	(SP)	2	*1	(CR)
*1: values 1–9 and A~Z										

Instruction to switch input to DIGITAL (Class1)

Character code in hexadecimal	25	31	49	4e	50	54	20	33		0d
Character	%	1	I	N	P	T	(SP)	3	*1	(CR)
*1: values 1–9										

Instruction to switch input to DIGITAL (Class2)

Character code in hexadecimal	25	32	49	4e	50	54	20	33		0d
Character	%	2	I	N	P	T	(SP)	3	*1	(CR)
*1: values 1–9 and A~Z										

Instruction to switch input to STORAGE (Class1)

Character code in hexadecimal	25	31	49	4e	50	54	20	34		0d
Character	%	1	I	N	P	T	(SP)	4	*1	(CR)
*1: values 1–9										

Instruction to switch input to STORAGE (Class2)

Character code in hexadecimal	25	32	49	4e	50	54	20	34		0d
Character	%	2	I	N	P	T	(SP)	4	*1	(CR)
*1: values 1–9 and A~Z										

Instruction to switch input to NETWORK (Class1)

Character code in hexadecimal	25	31	49	4e	50	54	20	35		0d
Character	%	1	I	N	P	T	(SP)	5	*1	(CR)
*1: values 1–9										

Instruction to switch input to NETWORK (Class2)

Character code in hexadecimal	25	32	49	4e	50	54	20	35		0d
Character	%	2	I	N	P	T	(SP)	5	*1	(CR)
*1: values 1–9 and A~Z										

Instruction to switch input to INTERNAL (Class2)

Character code in hexadecimal	25	32	49	4e	50	54	20	36		0d
Character	%	2	I	N	P	T	(SP)	6	*1	(CR)
*1: values 1–9 and A~Z										

Response (Class1)

Successful execution

Character code in hexadecimal	25	31	49	4e	50	54	3d	4f	4b	0d
Character	%	1	I	N	P	T	=	O	K	(CR)

Nonexistent input source

Character code in hexadecimal	25	31	49	4e	50	54	3d	45	52	52	32	0d
Character	%	1	I	N	P	T	=	E	R	R	2	(CR)

Unavailable time (standby, etc.)

Character code in hexadecimal	25	31	49	4e	50	54	3d	45	52	52	33	0d
Character	%	1	I	N	P	T	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	31	49	4e	50	54	3d	45	52	52	34	0d
Character	%	1	I	N	P	T	=	E	R	R	4	(CR)

Response (Class2)

Successful execution

Character code in hexadecimal	25	32	49	4e	50	54	3d	4f	4b	0d
Character	%	2	I	N	P	T	=	O	K	(CR)

Nonexistent input source

Character code in hexadecimal	25	32	49	4e	50	54	3d	45	52	52	32	0d
Character	%	2	I	N	P	T	=	E	R	R	2	(CR)

Unavailable time (standby, etc.)

Character code in hexadecimal	25	32	49	4e	50	54	3d	45	52	52	33	0d
Character	%	2	I	N	P	T	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	32	49	4e	50	54	3d	45	52	52	34	0d
Character	%	2	I	N	P	T	=	E	R	R	4	(CR)

4.4. Input switch query INPT ?

Input selection query (Class1)

Character code in hexadecimal	25	31	49	4e	50	54	20	3f	0d
Character	%	1	I	N	P	T	(SP)	?	(CR)

Input selection query (Class2)

Character code in hexadecimal	25	32	49	4e	50	54	20	3f	0d
Character	%	2	I	N	P	T	(SP)	?	(CR)

Response (Class1)

Successful execution

Character code in hexadecimal	25	31	49	4e	50	54	3d			0d
Character	%	1	I	N	P	T	=	*1		(CR)
*1: values 11–59										

Unavailable time (input switch underway, standby, etc.)

Character code in hexadecimal	25	31	49	4e	50	54	3d	45	52	52	33	0d
Character	%	1	I	N	P	T	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	31	49	4e	50	54	3d	45	52	52	34	0d
Character	%	1	I	N	P	T	=	E	R	R	4	(CR)

Response (Class2)

Successful execution

Character code in hexadecimal	25	32	49	4e	50	54	3d			0d
Character	%	2	I	N	P	T	=	*1		(CR)
*1: values 11–6Z										

Unavailable time (input switch underway, standby, etc.)

Character code in hexadecimal	25	32	49	4e	50	54	3d	45	52	52	33	0d
Character	%	2	I	N	P	T	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	32	49	4e	50	54	3d	45	52	52	34	0d
Character	%	2	I	N	P	T	=	E	R	R	4	(CR)

4.5. Mute instruction AVMT

Video mute ON instruction

Character code in hexadecimal	25	31	41	56	4d	54	20	31	31	0d
Character	%	1	A	V	M	T	(SP)	1	1	(CR)

Video mute OFF instruction

Character code in hexadecimal	25	31	41	56	4d	54	20	31	30	0d
Character	%	1	A	V	M	T	(SP)	1	0	(CR)

Audio mute ON instruction

Character code in hexadecimal	25	31	41	56	4d	54	20	32	31	0d
Character	%	1	A	V	M	T	(SP)	2	1	(CR)

Audio mute OFF instruction

Character code in hexadecimal	25	31	41	56	4d	54	20	32	30	0d
Character	%	1	A	V	M	T	(SP)	2	0	(CR)

Video and audio mute ON instruction

Character code in hexadecimal	25	31	41	56	4d	54	20	33	31	0d
Character	%	1	A	V	M	T	(SP)	3	1	(CR)

Video and audio mute OFF instruction

Character code in hexadecimal	25	31	41	56	4d	54	20	33	30	0d
Character	%	1	A	V	M	T	(SP)	3	0	(CR)

Response

Successful execution

Character code in hexadecimal	25	31	41	56	4d	54	3d	4f	4b	0d
Character	%	1	A	V	M	T	=	O	K	(CR)

Out-of-parameter

Character code in hexadecimal	25	31	41	56	4d	54	3d	45	52	52	32	0d
Character	%	1	A	V	M	T	=	E	R	R	2	(CR)

Unavailable time (standby, etc.)

Character code in hexadecimal	25	31	41	56	4d	54	3d	45	52	52	33	0d
Character	%	1	A	V	M	T	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	31	41	56	4d	54	3d	45	52	52	34	0d
Character	%	1	A	V	M	T	=	E	R	R	4	(CR)

If the mute function is individually executed or cancelled for the models that do not have audio or video mute functions, "ERR 2" (out of parameter range) is returned.

4.6. Mute status query AVMT ?

Video mute instruction

Character code in hexadecimal	25	31	41	56	4d	54	20	3f	0d
Character	%	1	A	V	M	T	(SP)	?	(CR)

Response

Successful execution

Character code in hexadecimal	25	31	41	56	4d	54	3d	*1	*2	0d
Character	%	1	A	V	M	T	=	*3		(CR)

*1 Values 31– 33 *2: values 30–31

*3

Video mute ON: 11
Audio mute ON: 21
Video and audio mute ON: 31 (models without audio function included)
Video and audio mute OFF: 30

Unavailable time (standby, etc.)

Character code in hexadecimal	25	31	41	56	4d	54	3d	45	52	52	33	0d
Character	%	1	A	V	M	T	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	31	41	56	4d	54	3d	45	52	52	34	0d
Character	%	1	A	V	M	T	=	E	R	R	4	(CR)

4.7. Error status query ERST ?

Error status query

Character code in hexadecimal	25	31	45	52	53	54	20	3f	0d
Character	%	1	E	R	S	T	(SP)	?	(CR)

Response

Successful execution

Character code in hexadecimal	25	31	45	52	53	54	3d							0d
Character	%	1	E	R	S	T	=	*1	*2	*3	*4	*5	*6	(CR)

*1 Fan error; any of 0–2
*2 Lamp error; any of 0–2
*3 Temperature error; any of 0–2
*4 Cover open error; any of 0–2
*5 Filter error; any of 0–2
*6 Other errors; any of 0–2

0: No error detected or no error detecting function
1: Warning
2: Error

Unavailable time (lamp ignition underway, etc.)

Character code in hexadecimal	25	31	45	52	53	54	3d	45	52	52	33	0d
Character	%	1	E	R	S	T	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	31	45	52	53	54	3d	45	52	52	34	0d
Character	%	1	E	R	S	T	=	E	R	R	4	(CR)

4.8. Lamp number/ lighting hour query LAMP ?

Lamp number and lighting hour query

Character code in hexadecimal	25	31	4c	41	4d	50	20	3f	0d
Character	%	1	L	A	M	P	(SP)	?	(CR)

Response

Projector with one lamp

Character code in hexadecimal	25	31	4c	41	4d	50	3d		・・・	
Character	%	1	L	A	M	P	=	*1		

Character code in hexadecimal	20		0d
Character	(SP)	*2	(CR)

*1 Usage time of the lamp: 0–99999 (variable length of one- to five-digit number)
*2 Lamp turned on: 1 Lamp turned off: 0

Projector with two lamps

Character code in hexadecimal	25	31	4c	41	4d	50	3d		・・・	
Character	%	1	L	A	M	P	=	*1		

Character code in hexadecimal	20		20		・・・		20		0d
Character	(SP)	*2	(SP)	*3			(SP)	*4	(CR)

*1 Usage time of lamp 1: 0–99999 (variable length of one- to five-digit number)
*2 Lamp 1 turned on: 1 Lamp 1 turned off: 0
*3 Usage time of lamp 2: 0–99999 (variable length of one- to five-digit number)
*4 Lamp 2 turned on: 1 Lamp 2 turned off: 0

Projector with n lamps

Character code in hexadecimal	25	31	4c	41	4d	50	3d		・・・	
Character	%	1	L	A	M	P	=	*1		

Character code in hexadecimal	20		20		・・・		20		20		・・・	
Character	(SP)	*2	(SP)	*3			(SP)	*4	(SP)	・・・		

Character code in hexadecimal		20		・・・		20		0d
Character	・・・	(SP)	*n			(SP)	*m	(CR)

*1 Usage time of lamp 1: 0–99999 (variable length of a one- to five-digit number)
*2 Lamp 1 turned on: 1 Lamp 1 turned off: 0
*3 Usage time of lamp 2: 0–99999 (variable length of a one- to five-digit number)
*4 Lamp 2 turned on: 1 Lamp 2 turned off: 0
・・・
*n Usage time of lamp n: 0–99999 (variable length of a one- to five-digit number)
*m Lamp n turned on: 1 Lamp n turned off: 0
Maximum value of n is 8. Maximum length of the parameter is [1 + 8 x n = 65] bytes.

* Usage time of lamp is always 0 when it is not counted by the projector.

No lamp

Character code in hexadecimal	25	31	4c	41	4d	50	3d	45	52	52	31	0d
Character	%	1	L	A	M	P	=	E	R	R	1	(CR)

Unavailable time for any reason

Character code in hexadecimal	25	31	4c	41	4d	50	3d	45	52	52	33	0d
Character	%	1	L	A	M	P	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	31	4c	41	4d	50	3d	45	52	52	34	0d
Character	%	1	L	A	M	P	=	E	R	R	4	(CR)

4.9. Input toggling list query INST ?

Input toggling list query (Class1)

Character code in hexadecimal	25	31	49	4e	53	54	20	3f	0d
Character	%	1	I	N	S	T	(SP)	?	(CR)

Input toggling list query (Class2)

Character code in hexadecimal	25	32	49	4e	53	54	20	3f	0d
Character	%	2	I	N	S	T	(SP)	?	(CR)

Response (Class1)

Character code in hexadecimal	25	31	49	4e	53	54	3d
Character	%	1	I	N	S	T	=

Character code in hexadecimal			20			20			0d
Character	*1		(SP)	*2		(SP)	*n		(CR)

*1 Number of the first input source available: 11–59
*2 Number of the second input source available: 11–59
・・・
*n Number of the n-th input source available: 11–59
Maximum value of n is 50. Maximum length of the parameter is 95bytes

Unavailable time (standby, etc.)

Character code in hexadecimal	25	31	49	4e	53	54	3d	45	52	52	33	0d
Character	%	1	I	N	S	T	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	31	49	4e	53	54	3d	45	52	52	34	0d
Character	%	1	I	N	S	T	=	E	R	R	4	(CR)

Response (Class2)

Character code in hexadecimal	25	32	49	4e	53	54	3d
Character	%	2	I	N	S	T	=

Character code in hexadecimal			20			20			0d
Character	*1		(SP)	*2		(SP)	*n		(CR)

*1 Number of the first input source available: 11–6Z
*2 Number of the second input source available: 11–6Z
・・・
*n Number of the n-th input source available: 11–6Z
Maximum value of n is 50. Maximum length of the parameter is 95bytes

Unavailable time (standby, etc.)

Character code in hexadecimal	25	32	49	4e	53	54	3d	45	52	52	33	0d
Character	%	2	I	N	S	T	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	32	49	4e	53	54	3d	45	52	52	34	0d
Character	%	2	I	N	S	T	=	E	R	R	4	(CR)

4.10. Projector/Display name query NAME ?

Projector/Display name query

Character code in hexadecimal	25	31	4e	41	4d	45	20	3f	0d
Character	%	1	N	A	M	E	(SP)	?	(CR)

Response

Character code in hexadecimal	25	31	4e	41	4d	45	3d			
Character	%	1	N	A	M	E	=			
Character code in hexadecimal	*1	*2	・・・	・・・	・・・	・・・	・・・	・・・	*n	0d
Character			・・・	・・・	・・・	・・・	・・・	・・・		(CR)

*1 Any character (20 to ff in hexadecimal)
*2 Any character (20 to ff in hexadecimal)
・・・
*n Any character (20 to ff in hexadecimal)
It is necessary to use UTF-8 for the character code set.
The value of n is 0–64
If there is no projector/display name, enter (CR) code directly after '='.

Unavailable time for any reason

Character code in hexadecimal	25	31	4e	41	4d	45	3d	45	52	52	33	0d
Character	%	1	N	A	M	E	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	31	4e	41	4d	45	3d	45	52	52	34	0d
Character	%	1	N	A	M	E	=	E	R	R	4	(CR)

4.11. Manufacture name information query INF1 ?

Manufacture name information query

Character code in hexadecimal	25	31	49	4e	46	31	20	3f	0d
Character	%	1	I	N	F	1	(SP)	?	(CR)

Response

Character code in hexadecimal	25	31	49	4e	46	31	3d
Character	%	1	I	N	F	1	=

Character code in hexadecimal	*1	*2	・・・	・・・	・・・	・・・	・・・	・・・	*n	0d
Character			・・・	・・・	・・・	・・・	・・・	・・・		(CR)

*1 Any character (20 to 7e in hexadecimal)
*2 Any character (20 to 7e in hexadecimal)
・・・
*n Any character (20 to 7e in hexadecimal)
The value of n is 0–32.
If there is no manufacture name, enter (CR) code directly after '='.

Unavailable time for any reason

Character code in hexadecimal	25	31	49	4e	46	31	3d	45	52	52	33	0d
Character	%	1	I	N	F	1	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	31	49	4e	46	31	3d	45	52	52	34	0d
Character	%	1	I	N	F	1	=	E	R	R	4	(CR)

4.12. Product name information query INF2 ?

Product name information query

Character code in hexadecimal	25	31	49	4e	46	32	20	3f	0d
Character	%	1	I	N	F	2	(SP)	?	(CR)

Response

Character code in hexadecimal	25	31	49	4e	46	32	3d
Character	%	1	I	N	F	2	=

Character code in hexadecimal	*1	*2	・・・	・・・	・・・	・・・	・・・	・・・	*n	0d
Character			・・・	・・・	・・・	・・・	・・・	・・・		(CR)

*1 Any character (20 to 7e in hexadecimal)
*2 Any character (20 to 7e in hexadecimal)
・・・
*n Any character (20 to 7e in hexadecimal)
The value of n is 0–32.
If there is no product name, enter (CR) code directly after '='.

Unavailable time for any reason

Character code in hexadecimal	25	31	49	4e	46	32	3d	45	52	52	33	0d
Character	%	1	I	N	F	2	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	31	49	4e	46	32	3d	45	52	52	34	0d
Character	%	1	I	N	F	2	=	E	R	R	4	(CR)

4.13. Other information query INFO ?

Other information query

Character code in hexadecimal	25	31	49	4e	46	4f	20	3f	0d
Character	%	1	I	N	F	O	(SP)	?	(CR)

Response

Character code in hexadecimal	25	31	49	4e	46	4f	3d
Character	%	1	I	N	F	O	=

Character code in hexadecimal	*1	*2	・・・	・・・	・・・	・・・	・・・	・・・	*n	0d
Character			・・・	・・・	・・・	・・・	・・・	・・・		(CR)

*1 Any character (20 to 7e in hexadecimal)
*2 Any character (20 to 7e in hexadecimal)
・・・
*n Any character (20 to 7e in hexadecimal)
The value of n is 0–32.
Other information of the projector/display described by the manufacture.
If there is no model information, enter (CR) code directly after '='.

Unavailable time for any reason

Character code in hexadecimal	25	31	49	4e	46	4f	3d	45	52	52	33	0d
Character	%	1	I	N	F	O	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	31	49	4e	46	4f	3d	45	52	52	34	0d
Character	%	1	I	N	F	O	=	E	R	R	4	(CR)

4.14. Class information query CLSS ?

Class information query

Character code in hexadecimal	25	31	43	4c	53	53	20	3f	0d
Character	%	1	C	L	S	S	(SP)	?	(CR)

Response (Class1)

Character code in hexadecimal	25	31	43	4c	53	53	3d	31	0d
Character	%	1	C	L	S	S	=	1	(CR)
Class1 model returns 1									

Response (Class2)

Character code in hexadecimal	25	31	43	4c	53	53	3d	32	0d
Character	%	1	C	L	S	S	=	2	(CR)
Class2 model returns 2									

Unavailable time for any reason

Character code in hexadecimal	25	31	43	4c	53	53	3d	45	52	52	33	0d
Character	%	1	C	L	S	S	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	31	43	4c	53	53	3d	45	52	52	34	0d
Character	%	1	C	L	S	S	=	E	R	R	4	(CR)

4.15. Serial number query SNUM ?

Serial number query

Character code in hexadecimal	25	32	53	4e	55	4d	20	3f	0d
Character	%	2	S	N	U	M	(SP)	?	(CR)

Response

Character code in hexadecimal	25	32	53	4e	55	4d	3d		…		0d
Character	%	2	S	N	U	M	=	*1			(CR)

*1 Any character of ASCII(20 to 7e in hexadecimal)Character length is 0-32.
The serial number information defined by the manufacturer is indicated.

No serial number information

Character code in hexadecimal	25	32	53	4e	55	4d	3d	0d
Character	%	2	S	N	U	M	=	(CR)

Unavailable time for any reason

Character code in hexadecimal	25	32	53	4e	55	4d	3d	45	52	52	33	0d
Character	%	2	S	N	U	M	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	32	53	4e	55	4d	3d	45	52	52	34	0d
Character	%	2	S	N	U	M	=	E	R	R	4	(CR)

4.16. Software version query SVER ?

Software version query

Character code in hexadecimal	25	32	53	56	45	52	20	3f	0d
Character	%	2	S	V	E	R	(SP)	?	(CR)

Response

Character code in hexadecimal	25	32	53	56	45	52	3d		…		0d
Character	%	2	S	V	E	R	=	*1			(CR)

*1 Any character of ASCII(20 to 7e in hexadecimal)
Character length is 0-32.
The version information of the software defined by the manufacturer is indicated.
Version information can be expressed in any way.

No software version information

Character code in hexadecimal	25	32	53	56	45	52	3d	0d
Character	%	2	S	V	E	R	=	(CR)

Unavailable time for any reason

Character code in hexadecimal	25	32	53	56	45	52	3d	45	52	52	33	0d
Character	%	2	S	V	E	R	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	32	53	56	45	52	3d	45	52	52	34	0d
Character	%	2	S	V	E	R	=	E	R	R	4	(CR)

4.17. Input terminal name query INNM ?

Input terminal name query

Character code in hexadecimal	25	32	49	4e	4e	4d	20	3f			0d
Character	%	2	I	N	N	M	(SP)	?	*1		(CR)

Response

Character code in hexadecimal	25	32	49	4e	4e	4d	3d		…		0d
Character	%	2	I	N	N	M	=	*2			(CR)

* 1 The numbers of switchable input source 11 to 6Z (terminal numbers that can be acquired with the INST command)
* 2 Name of input source specified in * 1 (UTF - 8 character string) Parameter length shall be 128 bytes or less.

Out-of-parameter

Character code in hexadecimal	25	32	49	4e	4e	4d	3d	45	52	52	32	0d
Character	%	2	I	N	N	M	=	E	R	R	2	(CR)

Unavailable time for any reason

Character code in hexadecimal	25	32	49	4e	4e	4d	3d	45	52	52	33	0d
Character	%	2	I	N	N	M	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	32	49	4e	4e	4d	3d	45	52	52	34	0d
Character	%	2	I	N	N	M	=	E	R	R	4	(CR)

INNM needs input source number at the time of the query.

The name of the response will be referred to the input source number.

Input terminal name	Input source number when input terminal query
PC	31(RGB1)
HDMI1	51(Digital1)
HDMI2	52(Digital2)

Character code in hexadecimal	25	32	49	4e	4e	4d	20	3f	33	31	0d
Character	%	2	I	N	N	M	(SP)	?	3	1	(CR)

Character code in hexadecimal	25	32	49	4e	4e	4d	3d	50	43	0d
Character	%	2	I	N	N	M	=	P	C	(CR)

4.18. Input resolution query IRES ?

Input resolution query

Character code in hexadecimal	25	32	49	52	45	53	20	3f	0d
Character	%	2	I	R	E	S	(SP)	?	(CR)

Response

Character code in hexadecimal	25	32	49	52	45	53	3d
Character	%	2	I	R	E	S	=

Character code in hexadecimal		…		78		…		0d
Character	*1			x	*2			(CR)

* 1 Horizontal resolution of input signal
* 2 Vertical resolution of input signal

There is no limit on the number of digits.

No signal input

Character code in hexadecimal	25	32	49	52	45	53	3d	2d	0d
Character	%	2	I	R	E	S	=	-	(CR)

Unknown signal

Character code in hexadecimal	25	32	49	52	45	53	3d	2a	0d
Character	%	2	I	R	E	S	=	*	(CR)

Unavailable time for any reason

Character code in hexadecimal	25	32	49	52	45	53	3d	45	52	52	33	0d
Character	%	2	I	R	E	S	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	32	49	52	45	53	3d	45	52	52	34	0d
Character	%	2	I	R	E	S	=	E	R	R	4	(CR)

4.19. Recommend resolution query RRES ?

Recommended resolution query

Character code in hexadecimal	25	32	52	52	45	53	20	3f	0d
Character	%	2	R	R	E	S	(SP)	?	(CR)

Response

Character code in hexadecimal	25	32	52	52	45	53	3d
Character	%	2	R	R	E	S	=

Character code in hexadecimal		…		78				0d
Character	*1			x	*2			(CR)

* 1 Horizontal recommend resolution
* 2 Vertical recommend resolution

There is no limit on the number of digits.

Unavailable time for any reason

Character code in hexadecimal	25	32	52	52	45	53	3d	45	52	52	33	0d
Character	%	2	R	R	E	S	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	32	52	52	45	53	3d	45	52	52	34	0d
Character	%	2	R	R	E	S	=	E	R	R	4	(CR)

4.20. Filter usage time query FILT ?

Filter usage time query

Character code in hexadecimal	25	32	46	49	4c	54	20	3f	0d
Character	%	2	F	I	L	T	(SP)	?	(CR)

Response

Character code in hexadecimal	25	32	46	49	4c	54	3d		…		0d
Character	%	2	F	I	L	T	=	* 1			(CR)

*1 Filter usage time: 0–99999 (variable length of one- to five-digit number)

Filter usage time is always 0 when it is not counted by the projector.

No filter

Character code in hexadecimal	25	32	46	49	4c	54	3d	45	52	52	31	0d
Character	%	2	F	I	L	T	=	E	R	R	1	(CR)

Unavailable time for any reason

Character code in hexadecimal	25	32	46	49	4c	54	3d	45	52	52	33	0d
Character	%	2	F	I	L	T	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	32	46	49	4c	54	3d	45	52	52	34	0d
Character	%	2	F	I	L	T	=	E	R	R	4	(CR)

4.21. Lamp replacement model number query RLMP ?

Lamp replacement model number query

Character code in hexadecimal	25	32	52	4c	4d	50	20	3f	0d
Character	%	2	R	L	M	P	(SP)	?	(CR)

Response

Character code in hexadecimal	25	32	52	4c	4d	50	3d		…		0d
Character	%	2	R	L	M	P	=	* 1			(CR)

*1 Lamp replacement model number.
Maximum length of the parameter is 128 bytes.
If there are multiple replacement model numbers, they are separated by (SP).

No replacement model number

Character code in hexadecimal	25	32	52	4c	4d	50	3d	0d
Character	%	2	R	L	M	P	=	(CR)

Unavailable time for any reason

Character code in hexadecimal	25	32	52	4c	4d	50	3d	45	52	52	33	0d
Character	%	2	R	L	M	P	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	32	52	4c	4d	50	3d	45	52	52	34	0d
Character	%	2	R	L	M	P	=	E	R	R	4	(CR)

4.22. Filter replacement model number query RFIL ?

Filter replacement model number query

Character code in hexadecimal	25	32	52	46	49	4c	20	3f	0d
Character	%	2	R	F	I	L	(SP)	?	(CR)

Response

Character code in hexadecimal	25	32	52	46	49	4c	3d		…		0d
Character	%	2	R	F	I	L	=	* 1			(CR)

*1 Filter replacement model number.
Maximum length of the parameter is 128 bytes.

If there are multiple replacement model numbers, they are separated by (SP).

No replacement model number

Character code in hexadecimal	25	32	52	46	49	4c	3d	0d
Character	%	2	R	F	I	L	=	(CR)

Unavailable time for any reason

Character code in hexadecimal	25	32	52	46	49	4c	3d	45	52	52	33	0d
Character	%	2	R	F	I	L	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	32	52	46	49	4c	3d	45	52	52	34	0d
Character	%	2	R	F	I	L	=	E	R	R	4	(CR)

4.23. Speaker volume adjustment instruction SVOL

Speaker volume adjustment instruction

Character code in hexadecimal	25	32	53	56	4f	4c	20		0d
Character	%	2	S	V	O	L	(SP)	* 1	(CR)

* 1 Specify 0 to decrease the speaker volume by one level from the current level
Specify 1 to increase the speaker volume by one level from the current level

Response

Successful execution

Character code in hexadecimal	25	32	53	56	4f	4c	3d	4f	4b	0d
Character	%	2	S	V	O	L	=	O	K	(CR)

If a speaker is not installed

Character code in hexadecimal	25	32	53	56	4f	4c	3d	45	52	52	31	0d
Character	%	2	S	V	O	L	=	E	R	R	1	(CR)

Out-of-parameter

Character code in hexadecimal	25	32	53	56	4f	4c	3d	45	52	52	32	0d
Character	%	2	S	V	O	L	=	E	R	R	2	(CR)

Unavailable time for any reason

Character code in hexadecimal	25	32	53	56	4f	4c	3d	45	52	52	33	0d
Character	%	2	S	V	O	L	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	32	53	56	4f	4c	3d	45	52	52	34	0d
Character	%	2	S	V	O	L	=	E	R	R	4	(CR)

* As for a specification to increase the speaker volume by one level when it is in the maximum state, and a specification to decrease the speaker volume by one level when it is in the minimum state, the response for a normal case is returned.

Here, the volume related to audio output (audio out, built-in speaker in equipment model, etc.) is referred to as the speaker volume.

4.24. Microphone volume adjustment command MVOL

Microphone volume adjustment instruction

Character code in hexadecimal	25	32	4d	56	4f	4c	20		0d
Character	%	2	M	V	O	L	(SP)	* 1	(CR)

*1 Specify 0 to decrease the microphone volume by one level from the current level
Specify 1 to increase the microphone volume by one level from the current level

Response

Successful execution

Character code in hexadecimal	25	32	4d	56	4f	4c	3d	4f	4b	0d
Character	%	2	M	V	O	L	=	O	K	(CR)

If a microphone is not installed

Character code in hexadecimal	25	32	4d	56	4f	4c	3d	45	52	52	31	0d
Character	%	2	M	V	O	L	=	E	R	R	1	(CR)

Out-of-parameter

Character code in hexadecimal	25	32	4d	56	4f	4c	3d	45	52	52	32	0d
Character	%	2	M	V	O	L	=	E	R	R	2	(CR)

Unavailable time for any reason

Character code in hexadecimal	25	32	4d	56	4f	4c	3d	45	52	52	33	0d
Character	%	2	M	V	O	L	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	32	4d	56	4f	4c	3d	45	52	52	34	0d
Character	%	2	M	V	O	L	=	E	R	R	4	(CR)

* As for a specification to increase the microphone volume by one level when it is in the maximum state, and a specification to decrease the microphone volume by one level when it is in the minimum state, the response for a normal case is returned.

Here, the volume related to voice input (audio in, microphone terminal to be input to the model, etc.) is referred to as the microphone volume.

4.25. Freeze instruction FREZ

Freeze instruction

Character code in hexadecimal	25	32	46	52	45	5a	20		0d
Character	%	2	F	R	E	Z	(SP)	*1	(CR)

*1 Specify 1 to freeze the screen
Specify 0 to cancel freeze

Response

Successful execution

Character code in hexadecimal	25	32	46	52	45	5a	3d	4f	4b	0d
Character	%	2	F	R	E	Z	=	O	K	(CR)

Not supported

Character code in hexadecimal	25	32	46	52	45	5a	3d	45	52	52	31	0d
Character	%	2	F	R	E	Z	=	E	R	R	1	(CR)

Out-of-Parameter

Character code in hexadecimal	25	32	46	52	45	5a	3d	45	52	52	32	0d
Character	%	2	F	R	E	Z	=	E	R	R	2	(CR)

Unavailable time for any reason

Character code in hexadecimal	25	32	46	52	45	5a	3d	45	52	52	33	0d
Character	%	2	F	R	E	Z	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	32	46	52	45	5a	3d	45	52	52	34	0d
Character	%	2	F	R	E	Z	=	E	R	R	4	(CR)

4.26. Freeze status query FREZ ?

Freeze status query

Character code in hexadecimal	25	32	46	52	45	5a	20	3f	0d
Character	%	2	F	R	E	Z	(SP)	?	(CR)

Response

Successful execution

Character code in hexadecimal	25	32	46	52	45	5a	3d		0d
Character	%	2	F	R	E	Z	=	*1	(CR)

*1 Freeze status
Freeze status ON: 1
Freeze status OFF:0

Not Supported

Character code in hexadecimal	25	32	46	52	45	5a	3d	45	52	52	31	0d
Character	%	2	F	R	E	Z	=	E	R	R	1	(CR)

Unavailable time for any reason

Character code in hexadecimal	25	32	46	52	45	5a	3d	45	52	52	33	0d
Character	%	2	F	R	E	Z	=	E	R	R	3	(CR)

Projector/Display failure

Character code in hexadecimal	25	32	46	52	45	5a	3d	45	52	52	34	0d
Character	%	2	F	R	E	Z	=	E	R	R	4	(CR)

5. Authentication

5.1. Authentication procedure

To enter into communication with each other using PJLINK commands, both the projector/display and the CONTROLLER must carry out the authentication procedure in advance. The method used for skipping the authentication procedure is explained in Chapter 5.2.
An authentication procedure is executed once after each establishment of TCP/IP connection. Without passing through the authentication procedure, the projector/display will not accept PJLINK commands and subsequent operations.
The data sent to the network will be a 32-byte hash value obtained by encrypting the XOR computed value of random numbers generated by the projector/display and controller and the password using the SHA256 hash algorithm.
The authentication procedure involves a password verification process. A password message sent to the network will be converted into a 32-byte encrypted message with a random number assigned by the projector/display, and the MD5 algorithm.

The password and other parameters to be used in authentication must meet the following requirements:

Parameter	Character string specification
Password	32 or fewer ASCII alphanumeric characters
Random number (4-bytes)	8 ASCII hexadecimal characters
Random number (16-bytes)	32 ASCII hexadecimal characters
Hash value	64 ASCII hexadecimal characters

The steps of the authentication procedure are as follows:

1. The CONTROLLER connects to the projector/display.
2. The projector/display responds in the form of (1-1). This response includes the header 'PJLINK,' '1' indicating the authentication procedure, and a random number value (4-bytes) generated by the projector/display.
3. The controller receiving the response confirms the correctness of the content and then queries the projector/controller in the form of (1-2) to check the corresponding security level.
4. The projector/display responds in the form of (1-3). This response includes the header 'PJLINK,' '2' indicating that SHA256 is supported, and a random number value (16-bytes) generated by the projector/display.
5. The controller receiving the response checks the correctness of the content and generates a random number (16-bytes). The XOR value of that random number value and the random number value received from the projector/controller is calculated. From that value and the password held by the controller, a hash value is generated using the SHA256 algorithm. In the form of (1-4), the random number value generated by the controller and the generated hash value are added to the beginning of the PJLink command and sent to the projector/display. The detailed encryption procedure is shown in (1-5).

If the projector/display does not respond as specified in this document (ERR response, incorrect

response, no response, session disconnection, etc.), the projector/display does not support the security level specified in this specification. Therefore, after terminating the session, the connection will be made using the protocol defined in the old specification.

6. The projector/display compares the random number value generated by the projector/display, the random number value received from the controller, the hash value calculated by the SHA256 algorithm from the password set in the projector/display, and the hash value sent from the controller. The comparison procedure is shown in (1-6).

If the results are the same, the PJLink command can be received and executed in that TCP/IP session. If the projector/display does not receive data within 30 seconds after sending the response in (1-1), the connection is forcibly disconnected due to timeout and returns to a state of standby.

7. If the hash values match, the projector/display sends a response to the PJLink command to the controller and continues to maintain the TCP session. If the hash value does not match, the projector/display sends an error response in the form of (1-8) to the controller after 2 seconds and waits for the controller to disconnect. If the controller does not disconnect, the projector/display disconnects 30 seconds after the error response

The following are examples using the password and random number:

Password	JBMIAProjectorLink
Projector/display random number (4-bytes)	0x498e4a67
Projector/display random number (16-bytes)	0x3db25e10f69c47a85adb24cf361897e0
Controller random number (16-bytes)	0xc14b279e603d8a5f17e849ba360f2dc5

(1-1) Response from projector/display

Character code in hexadecimal	50	4a	4c	49	4e	4b	20	31	20
Character	P	J	L	I	N	K	(SP)	1	(SP)

Character code in hexadecimal	34	39	38	65	34	61	36	37	0d
Character	4	9	8	e	4	a	6	7	(CR)

(1-2) Inquiry to projector/display (Check security level)

Character code in hexadecimal	50	4a	4c	49	4e	4b	20	32	0d
Character	P	J	L	I	N	K	(SP)	2	(CR)

(1-3) Response from projector/display

16 進数 文字コード	50	4a	4c	49	4e	4b	20	32	20
文字	P	J	L	I	N	K	(SP)	2	(SP)

Character code in hexadecimal	50	4a	4c	49	4e	4b	20	32	20
Character	P	J	L	I	N	K	(SP)	2	(SP)

Character code in hexadecimal	33	64	62	32	35	65	31	30	66	36	39	63	34	37	61	38
Character	3	d	b	2	5	e	1	0	f	6	9	c	4	7	a	8

Character code in hexadecimal	35	61	64	62	32	34	63	66	33	36	31	38	39	37	65	30
Character	5	a	d	b	2	4	c	f	3	6	1	8	9	7	e	0

Character code in hexadecimal	0d
Character	(CR)

(1-4) Send controller-generated random number value + hash value + command to projector/display

Character code in hexadecimal	63	31	34	62	32	37	39	65	36	30	33	64	38	61	35	66
Character	c	1	4	b	2	7	9	e	6	0	3	d	8	a	5	f

Character code in hexadecimal	31	37	65	38	34	39	62	61	33	36	30	66	32	64	63	35
Character	1	7	e	8	4	9	b	a	3	6	0	6	2	d	c	5

Character code in hexadecimal	37	30	61	62	31	32	39	65	61	63	36	39	32	34	64	34
Character	7	0	a	b	1	2	9	e	a	c	6	9	2	4	d	4

Character code in hexadecimal	63	31	32	39	63	39	63	34	66	63	66	34	35	62	65	34
Character	c	1	2	9	c	9	c	4	f	c	f	4	5	b	e	4

Character code in hexadecimal	32	65	31	65	37	37	36	33	32	35	61	36	36	64	62	36
Character	2	e	1	e	7	7	6	3	2	5	a	6	6	d	b	6

Character code in hexadecimal	37	65	35	62	36	65	65	65	35	30	66	32	61	36	39	32
Character	7	e	5	b	6	e	e	e	5	0	f	2	a	6	9	2

Character code in hexadecimal	25	31	50	4f	57	52	20	31	0d
Character	%	1	P	O	W	R	(SP)	1	(CR)

(1-5) Encryption procedure

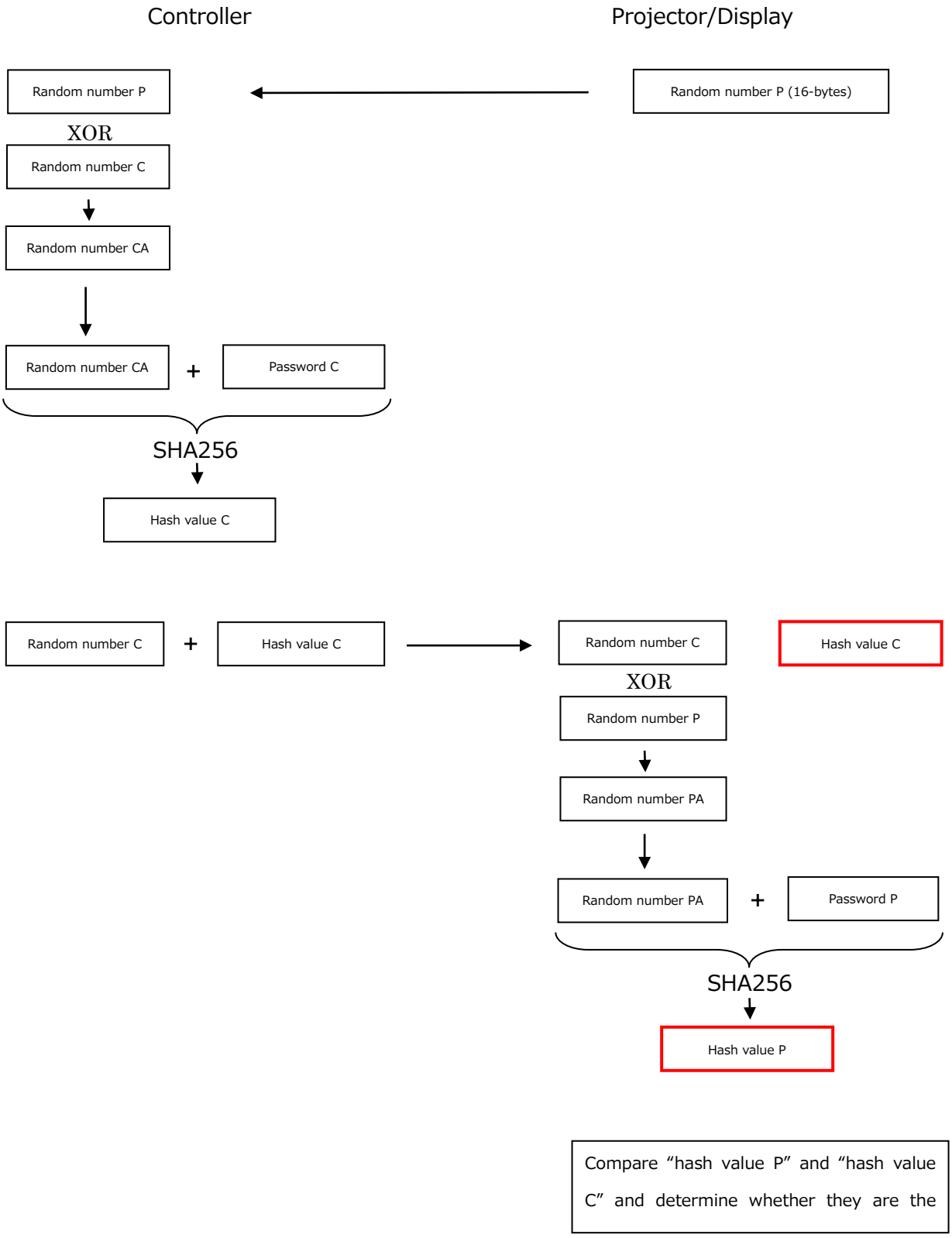
After calculating the XOR value 0xfcf9798e96a1cdf74d336d750017ba25 (16- byte binary data) between the random number value 0x3db25e10f69c47a85adb24cf361897e0 (16-byte binary data) obtained from the projector/display and the random number value0xc14b279e603d8a5f17e849ba360f2dc5 (16-byte binary data) generated by the controller, a hash value 0x70ab129eac6924d4c129c9c4fcf45be42e1e776325a66db67e5b6eee 50f2a692(32-byte binary data) is generated using the SHA256 algorithm based on the value

"fcf9798e96a1cdf74d336d7500 17ba25JBMIAProjectorLink" obtained by connecting the character string data of this value and the password character string stored in the controller.

(1-6) Comparison Procedure

After calculating the XOR value 0xfcf9798e96a1cdf74d336d750017ba25 (16- byte binary data) between the random number value 0xc14b279e603d8a5f17e849ba360f2dc5 (16-byte binary data) received from the controller and the random number value 0x3db25e10f69c47a85adb24cf361897e0 (16-byte binary data) generated by the projector, the integrity of the password is checked by comparing the hash value received from the controller with the hash value 0x70ab129eac6924d4c129c9c4fcf45be42e1e776325 a66db67e5b6eee50f2a692 (32-byte binary data) generated using the SHA256 algorithm from the value obtained by connecting the string of this value with the password string held in the projector/display.

(1-7) Flow of hash value generation and comparison



(1-8) Password mismatch error response

Character code in hexadecimal	50	4a	4c	49	4e	4b	20	45	52	52	41	0d
Character	P	J	L	I	N	K	(SP)	E	R	R	A	(CR)

(ERRA stands for Error Authorization.)

5.2. No authentication procedure (Security nullification)

The password authentication procedure may be skipped upon such user setting (security nullification).

If the projector/display does not have a password saved or the security function of the projector/display is turned off, the projector/display transmits (1-9) as the first response after communication. If the controller receives this response, it can be sent to the PJLink command without adding authentication data.

(1-9) Response from projector/display (security OFF)

Character code in hexadecimal	50	4a	4c	49	4e	4b	20	30	0d
Character	P	J	L	I	N	K	(SP)	0	(CR)

5.3. Continuous command transmissions on the same connection

Within 30 seconds after the projector/display sends its last response, and while a TCP connection is still established, the controller can continue to send PJLink commands. There is no limit to the number of command transmissions in this state.

However, if the next command is sent without waiting for a response from the projector/display, the command response and the processing of the projector/display corresponding to the command are not guaranteed.

For the second and subsequent PJLink command transmissions, the authentication data added to the beginning of the command for the authentication procedure can be omitted. However, there is no problem if an encrypted password string is added in the second and subsequent command transmissions..

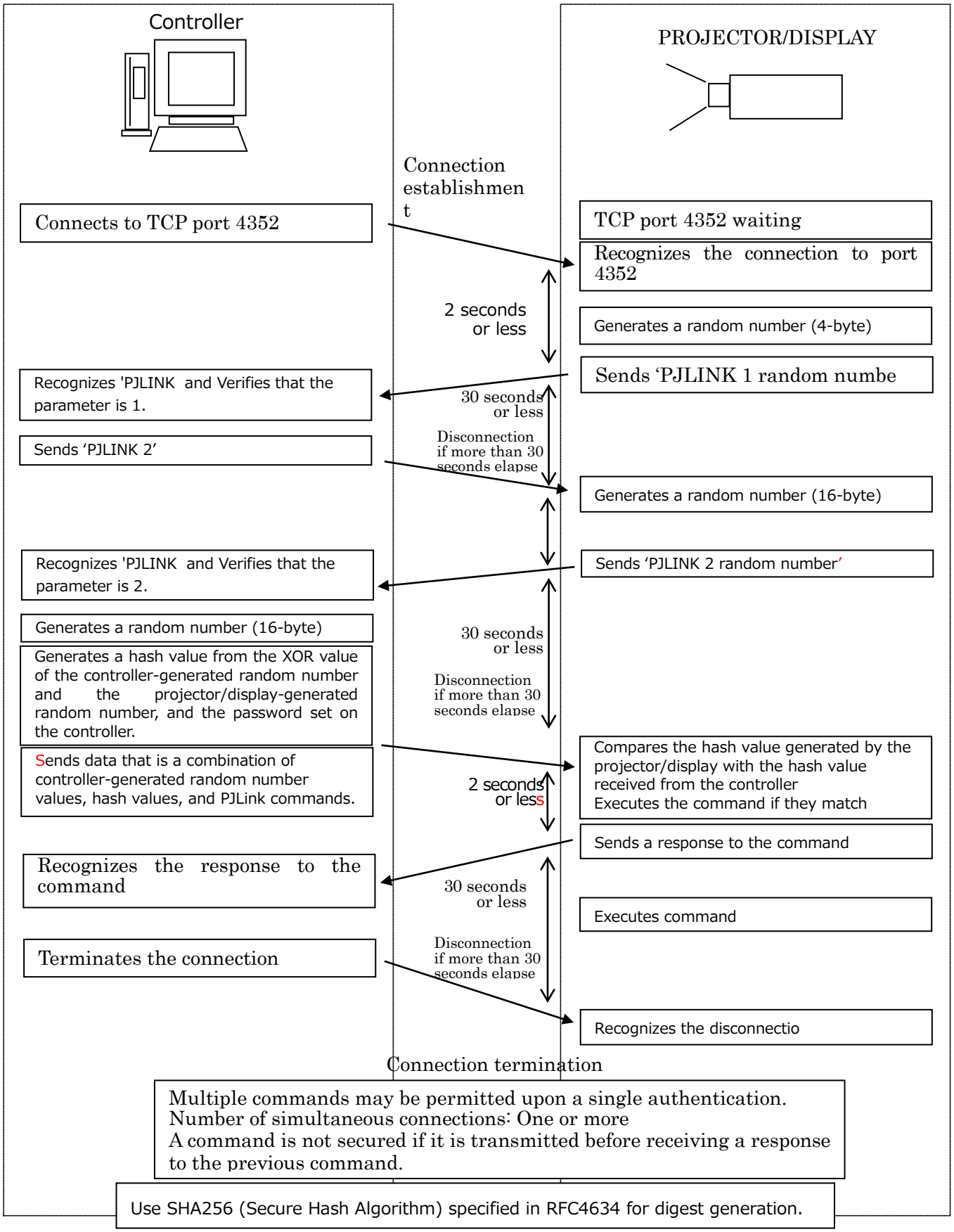
5.4. Disconnection

The CONTROLLER must terminate the TCP connection as soon as the required command transmission is completed.

If, for some reason, the projector/display disconnects from the controller or does not receive a new PJLink command within 30 seconds after sending the last response, the projector/display will forcibly disconnect from the TCP connection, release resources, and return again to the standby state (timeout processing).

An example of the connection protocol is shown below.

Fig. 1: Projector/Display security is active】



【Fig. 2: Example of Power ON when Projector/Display security is active】

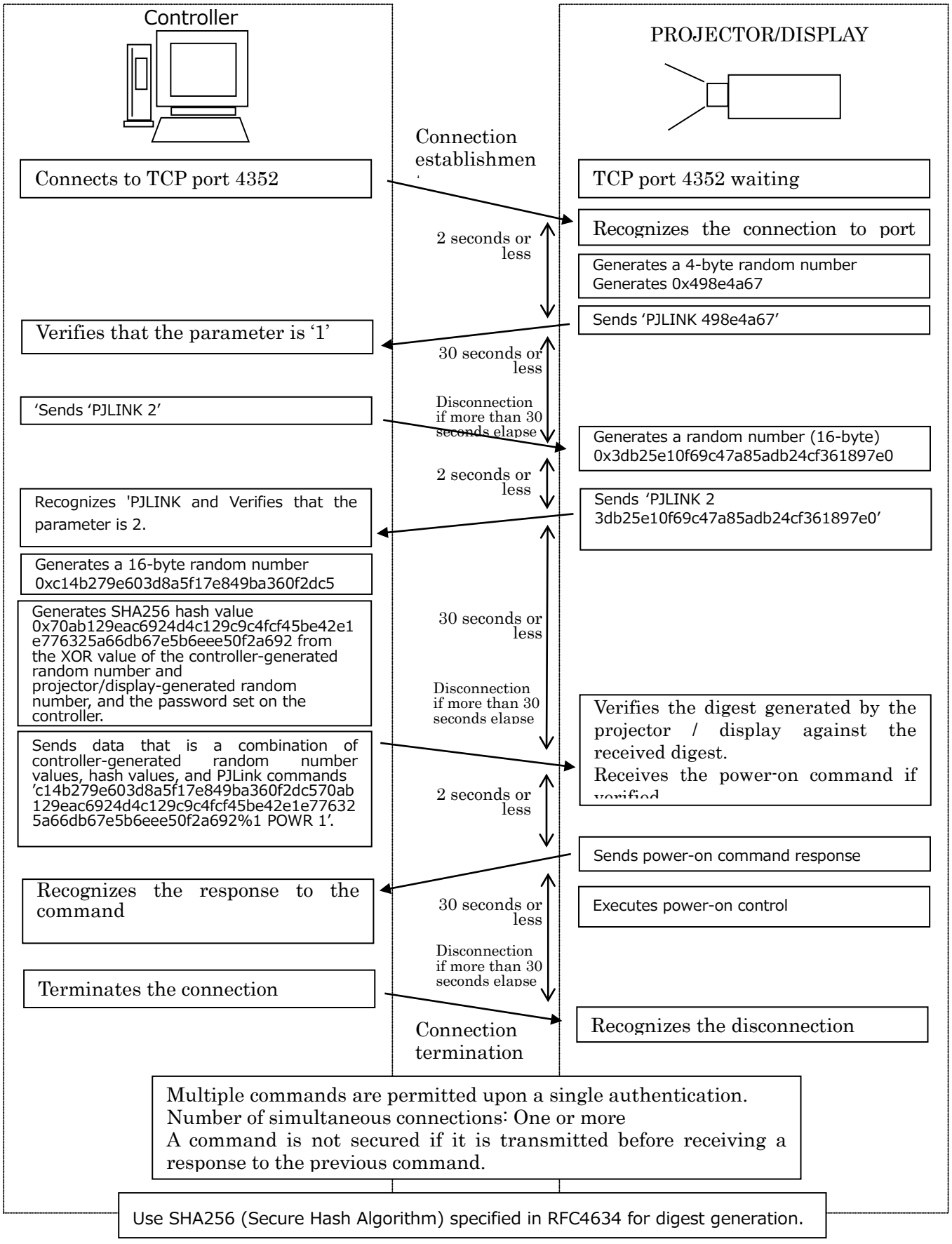
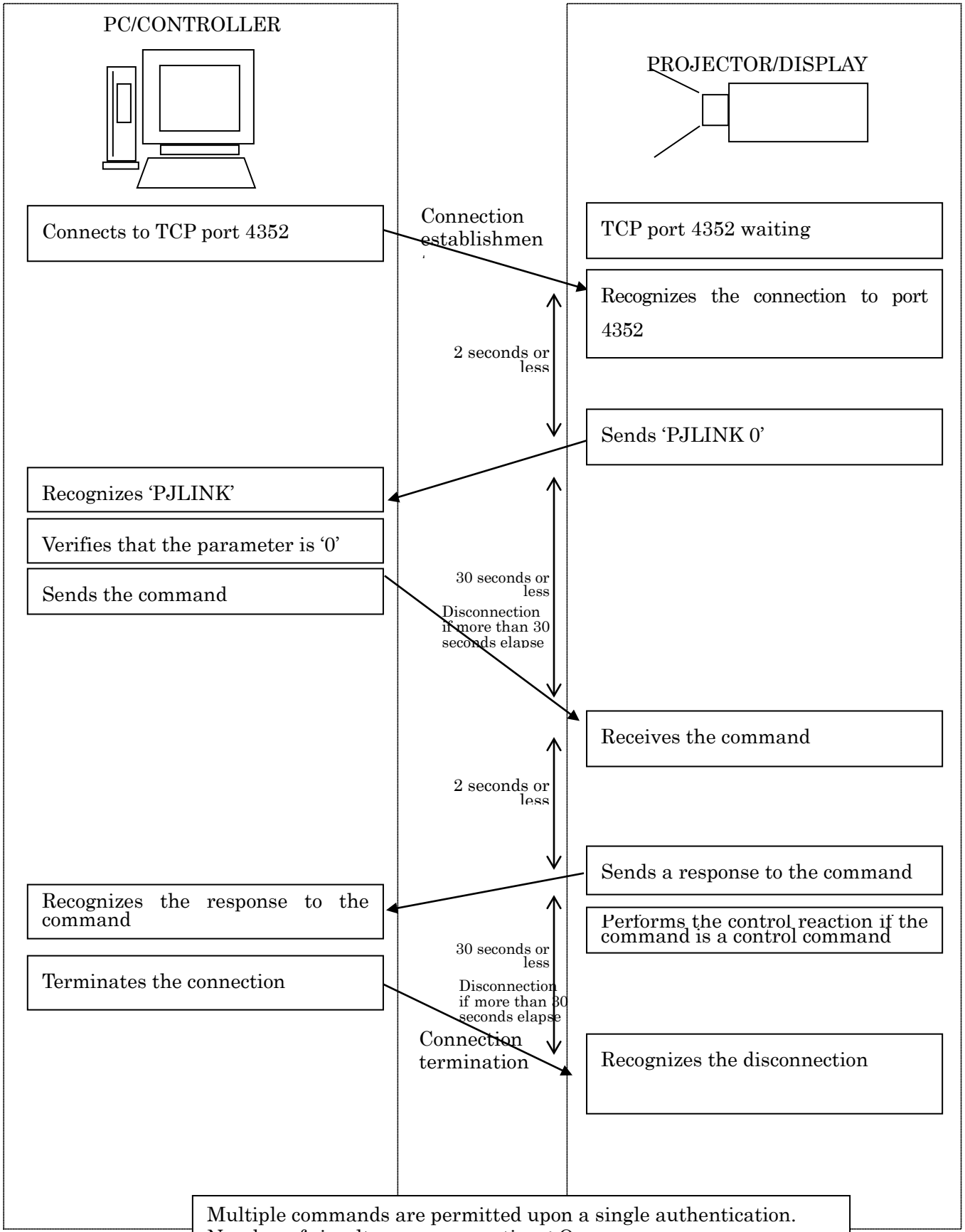


Fig. 3: No authentication procedure of the projector/display (Security OFF)】



6. Application Conventions

Constraints on the use of PJLink are as follows:

[Connection method]

This command is for network connection only and does not support other connections such as serial port and USB connections.

[About IPv6 address]

・Since it is possible to assign multiple IPv6 addresses to one device, it is necessary to clarify which one is to be used. Generally, the priority is determined and returned based on the IPv6 address selection policy table described in RFC 3484.

Reference Table RFC3484 IPv6 Default address selection policy table

Prefix	Precedence	Label
::1/128	50	0
::/0	40	1
2002::/16	30	2
::/96	20	3
::ffff:0:0/96	10	4

[Authentication]

When the security mode of the projector/display is active, it is necessary to perform the authentication procedure. Without successful authentication, none of the commands can be used. For details of the authentication procedure, refer to [5. Authentication].

However, 3.2 search protocols and 3.3 state protocols added from Class 2 communicate without authentication procedures.

[Receiving time]

Commands sent within the following periods of time are not guaranteed to transmit successfully:

Approximately 10 seconds (*2) immediately after the projector/display starts power-on (*1)

When the projector/display switches the signal (*3)

Time interval between the projector's/display's reception of a command and its issuance of a response command

Time interval between the projector's/display's completion of lamp cooling and its change of status to standby

*1: The timing of the projector's/display's status change from standby to video projection
*2: Refer to the specification of the projector/display.
*3: Signal switching due to input terminal switch and input signal change included.

[Simultaneous connection]

・The number of CONTROLLERs to be connected simultaneously varies with the projector/display model. Refer to the specifications of the projector/display.

- Simultaneous commands from multiple CONTROLLERs are not guaranteed to transmit successfully.

- As for commands transmitted from multiple CONTROLLERs, the last received command will be effective.

[Automatic disconnection]

The projector/display terminates the connection if it does not receive a command within 30 seconds after establishment of the connection or after the issuance of a response command.

[Response method]

The projector/display issues a response command within 2 seconds (*1) after receiving a command. However, it will not issue a response command when it receives a command that does not meet command format requirements. See Chapter 2 for the command format requirements.

*1:Refer to the specifications of the projector/display.

[Search protocol]

・Since it is a protocol using UDP, there is a possibility that the search start command of the application does not reach the projector/display, or the search response does not reach the application.

・When it is immediately after activation of the projector/display, the search response may not be available.

[Status Notification Protocol]

・Since it is a protocol using UDP, the status notification of the projector/display may not reach the application.

・The number of host addresses that can be registered as a notification destination is at least 1, and no further specification is made in this specification with respect to more addresses. Refer to the specifications of each projector/display.

・Any mechanism such as the mechanism of changing notification destination for each state of occurrence is not prescribed in this specification. Refer to the specifications of each projector/display.

Adding commands or parameters specified in this specification, or using them for different purposes is prohibited.

[Prohibitions]

It is prohibited to use the commands and parameters specified in this specification for additional or different purposes.

7. change history

2016.7 1　Version 2.00

2016.9.27 Version 2.01 Changed lamp totalization time to lamp usage time

2017.1.13 Version 2.02 Added detailed description of INNM command, corrected typo in Figure 2

2024.3.22 Version 2.10 Enhanced authentication security